International Journal of Health Policy and Management, 2013, 1(4), 301–306

Kerman University of Medical Sciences

International Journal of
Health Policy and Management

Journal homepage: http://ijhpm.com

Original Article

The Effect of Fiscal Decentralization on Under-five Mortality in Iran: A Panel Data Analysis

Ali Hussein Samadi[1], Ali Keshtkaran[2,*], Zahra Kavosi[2], Sajad Vahedi[2]

[1]Department of Economics, School of Economics, Management and Social Sciences, Shiraz University, Shiraz, Iran
[2]School of Management and Medical Informatics, Shiraz University of Medical Sciences, Shiraz, Iran

ARTICLE INFO

Article History:
Received: 22 September 2013
Accepted: 14 November 2013
ePublished: 27 November 2013

Keywords:
Fiscal Decentralization
Under-five Mortality
Panel Data
Fixed and Random Effects
Iran

ABSTRACT

Background: Fiscal Decentralization (FD) in many cases is encouraged as a strong means of improving the efficiency and equity in the provision of public goods, such as healthcare services. This issue has urged the researchers to experimentally examine the relationship between fiscal decentralization indicators and health outcomes. In this study we examine the effect of Fiscal Decentralization in Medical Universities (FDMU) and Fiscal Decentralization in Provincial Revenues (FDPR) on Under-Five Mortality Rate (U5M) in provinces of Iran over the period between 2007 and 2010.
Methods: We employed panel data methods in this article. The results of the Pesaran CD test demonstrated that most of the variables used in the analysis were cross-sectionally dependent. The Hausman test results suggested that fixed-effects were more appropriate to estimate our model. We estimated the fixed-effect model by using Driscoll-Kraay standard errors as a remedy for cross-sectional dependency.
Results: According to the findings of this research, fiscal decentralization in the health sector had a negative impact on U5M. On the other hand, fiscal decentralization in provincial revenues had a positive impact on U5M. In addition, U5M had a negative association with the density of physicians, hospital beds, and provincial GDP per capita, but a positive relationship with Gini coefficient and unemployment.
Conclusion: The findings of our study indicated that fiscal decentralization should be emphasized in the health sector. The results suggest the need for caution in the implementation of fiscal decentralization in provincial revenues.

Background

Decentralization has become a major topic in both developed and developing countries (1). Decentralization is a transferring authority in planning, decision-making, and management of the central level to local levels (2). The logic of decentralization is based on an intrinsically powerful idea. It is simply stated that smaller organizations, properly structured and steered, are inherently more agile and accountable compared to the larger ones (3).

Most of the proponents of decentralization believe that politicians, by employing decentralization, could bring transparency and responsibility for the local elector and hence allow well accommodation of the public goods according to the local needs (4).

Decentralization is a complex idea that includes the shifting of fiscal, political, and administrative tasks to local levels (5,6). In this article we emphasized on Fiscal Decentralization (FD). The FD is the transfer of fiscal power from the national government to sub-national governments (4). The theories of FD are proposed to improve the provision of public goods, particularly local public goods that should be provided according to the local needs. By applying FD policies, it is expected that productivity, efficiency, equity, and accountability of the local managers increase regarding resources allocation (7,8).

Decentralization, as a powerful means, has been suggested for the provision of public goods, such as healthcare services (5,9,10). The pleasurable impact of decentralization on healthcare services is based on this assumption that local decision makers can receive better information and, consequently, provide a more effective reaction to the local needs. Also, decentralization can be a route for the people to express their preferences. Accordingly, decentralized plans that are based on the local circumstances and needs have this advantage (1,5,11).

The pathway through which decentralization will more likely improve the health outcomes, is the increase in allocative and technical efficiency. It is expected that a decentralized system, allocates economical resources more efficiently in order to maximize the health outcomes (11).

It should be noted that in some cases, delegation of authority to local levels leads to failure. In public goods provision, due to the spillover effects, local governments with free riding intend to take advantage of these goods with the lowest expenditures. It has been argued that some healthcare programs may not perform better at the local levels because they either require a

***Corresponding author:** Ali Keshtkaran; Email: keshtkaa@sums.ac.ir

Citation: Samadi AH, Keshtkaran A, Kavosi Z, Vahedi S. The effect of fiscal decentralization on under-five mortality in Iran: a panel data analysis. *International Journal of Health Policy and Management* 2013; 1: 301–306.

national perspective or may not be cost effective. In addition, this concern has existed that by transferring the financial responsibility to the local levels, inequality may occur in financing some public goods, such as healthcare services (5,12).

In Iran, attention has been paid to decentralization affairs with respect to the 5-year development plans. The decentralization issue in Iran has been more emphasized after the Third Plan of Development (13). The main step of decentralization has been taken through the development of provincial revenue and expenditure system (14).

Iran's healthcare system is decentralized with the authority at the provincial level. The system has been succeeded in agglomeration of medical education and healthcare services provision. In the current structure of the healthcare system in Iran, the primary healthcare networks reach the urban levels (15). In the provincial level, medical universities supervise the healthcare system and medical education. These universities can decide about budgeting, allocation of local revenues, and financial affairs, too (16). Moreover, the independence of public hospitals has been highlighted in the Iranian health system (17).

The main goal of this research is to examine the relationship between FD and Under-Five Mortality rate (U5M) as a health outcome in the provinces of Iran between 2007 and 2010. We also investigate the effects of some determinants of children's health on U5M. The U5M is measured as probability, or the proportion of the children dying before their fifth birthday (18). Reduction in the U5M is in fact the fourth goal of the Millennium Development Goals (MDGs) (19). The investigation of the determinants of health among children is important because it illustrates the lasting impact of childhood health on adulthood (20).

Empirical studies

Despite the fact that decentralization is a captivating issue for researchers, empirical studies on FD and health outcomes are limited. In this section, we reviewed some relevant investigations.

A study by Robalino and colleagues showed that, FD defined as the proportion of sub-national government spending over central government spending was correlated with a decrease in infant mortality. In addition, the authors concluded that decentralization was far more advantageous for poor countries (10). Using a large panel of Argentine provinces over the period 1970–1994, Habibi *et al.* showed that infant mortality decreased with two indicators of FD. Besides, this study showed that inequalities in regional infant mortality rates declined significantly over the period when the decentralization reforms were implemented (21).

Furthermore, Cantarero and Pascual concluded that by increasing the local healthcare expenditures, infant mortality was reduced and life expectancy was increased in the provinces of Spain (22). In another study, Asfaw *et al.* showed that decentralization played a prominent role in reducing the mortality of infants in Indian villages (5). Other works such as Uchimura and Jütting (1), Jiménez (23), Akpan *et al.* (24), Jiménez (11), and Soto *et al.* (25) also showed a positive relationship between decentralization and health outcomes.

Using panel data, Jin and Son analyzed the impact of FD on infant mortality in the provinces of China. They showed that FD had a positive impact on infant mortality (26). It should be noted that different indicators were used as FD in health sector and public sector in these studies (Table 1).

To date, the relationship between FD and health outcomes has not been empirically investigated in Iran. Hence, our goal in this article was to investigate the potential impact of FD on U5M as a health outcome.

The rest of the paper is divided into three sections. Subjects and Methods are divided into the econometric model, data collection and estimation methods. The next section of this article is continued with Findings. Finally this article ends with discussion and conclusion sections.

Table 1. FD indicators in related studies

Study	Article	Indicator
Robalino *et al.* (10)	Does fiscal decentralization improve health outcomes? Evidence from a cross-country analysis	The proportion of sub-national government spending over central government spending
Habibi *et al.* (21)	Decentralization and human development in Argentina	The proportion of revenue raised locally and the proportion of controlled revenue over the total
Asfaw *et al.* (5)	Fiscal decentralization and health outcomes: Empirical evidence from rural India	Fiscal decentralization obtained by factor analysis on the basis of three variables (the share of local (rural) expenditure on total state (intermediate government tier) expenditure, the total local expenditure per rural population, and the share of local own revenue from the total local expenditure)
Cantarero and Pascual (22)	Analyzing the impact of fiscal decentralization on health outcomes: Empirical evidence from Spain	The ratio of sub-national healthcare expenditure to the total health expenditure for all the levels of government
Uchimura and Jütting (1)	Fiscal decentralization, Chinese style: Good for health outcomes?	The measure of vertical balance, and the ratio of county's aggregate expenditure to total provincial expenditure
Jiménez-Rubio (23)	The impact of decentralization of health services on health outcomes: Evidence from Canada	The ratio of provincial healthcare expenditure over the total
Akpan (24)	Fiscal decentralization and social outcomes in Nigeria	The total revenue of state governments divided by the total revenue of central and state governments
Jiménez-Rubio (11)	The impact of fiscal decentralization on infant mortality rates: Evidence from OECD countries	1. Sub-national own tax revenue over general government total revenue. Taxes in the numerator include only those where the sub-national government can change the tax rate, the tax base or both 2. Sub-national tax revenue over general government total revenue
Soto *et al.* (25)	Fiscal decentralization and infant mortality rate: The Colombian case	Locally controlled health expenditure as the proportion of total health expenditure

Citation: Samadi AH, Keshtkaran A, Kavosi Z, Vahedi S. The effect of fiscal decentralization on under-five mortality in Iran: a panel data analysis. *International Journal of Health Policy and Management* 2013; 1: 301–306.

Methods

Data and Variables

In this study, we emphasized two FD indicators. The first indicator focuses on FD in the health sector; the ratio of expenditures from the local revenues to the total expenditures from local and public revenues of medical universities (FDU). The second indicator covers provincial level of decentralization; the ratio of provincial revenues to the total provincial and central revenues (FDR). The data for FDU were obtained from the statistics of the public and private credits of the medical universities provided by the Ministry of Health and Medical Education (MoHME). We used the data from the provincial budgets to measure the FDR. Data on U5M were obtained from MoHME. Provincial per capita revenue, physicians, hospital beds, urbanization, and unemployment, were extracted from the provincial yearbook. In addition, the data on Gini coefficient were acquired from the statistics center (27–30). It should be pointed that the effects of these variables have been investigated in different studies (22,31–41).

The econometric model

According to Uchimura and Jütting basic model (equation 1), we examined the impact of FD and other factors on U5M.

$$H_{it}=\alpha+\beta X_{it}+\gamma Z_{it}+U_{it,} \quad (1)$$

Where "i" denotes cross-section, "t" denotes time, "H" denotes U5M, "X" is the FD indicator, and "Z" denotes the control variables.

We emphasized two FD indicators. In the first indicator, by focusing on FD in the health sector, FD was defined as the ratio of expenditures from the local revenues to the total expenditures from local and public revenues of medical universities (FDU). In the second indicator, the FD was defined as the ratio of provincial revenues to the total provincial and central revenues (FDR). Since we used two FD indicators in the analysis, two equations were estimated. In the first equation, we tested the impact of FDU on U5M using equation (2):

$$H_{it}=FDU_{it}^{\beta_1}\times GDP_{it}^{\beta_2}\times DOC_{it}^{\beta_3}\times BED_{it}^{\beta_4}\times GIN_{it}^{\beta_5}\times UNEM_{it}^{\beta_6}\times UR_{it}^{\beta_7} \quad (2)$$

The logarithm form of this equation is shown in equation (3):

$$LH_{it}=\beta_0+\beta_1 LFDU_{it}+\beta_2 LGDP_{it}+\beta_3 LDOC_{it}+\beta_4 LBED_{it}+\beta_5 LGIN_{it}+\beta_6 L\,UNEM_{it}+\beta_7 LUR_{it}+U_{it} \quad (3)$$

In addition, we investigated the impact of FDR on U5M using equation (4):

$$H_{it}=FDR_{it}^{\beta_1}\times GDP_{it}^{\beta_2}\times DOC_{it}^{\beta_3}\times BED_{it}^{\beta_4}\times GIN_{it}^{\beta_5}\times UNEM_{it}^{\beta_6}\times UR_{it}^{\beta_7} \quad (4)$$

The logarithm form of this equation is shown in equation (5):

$$LH_{it}=\beta_0+\beta_1 LFDR_{it}+\beta_2 LGDP_{it}+\beta_3 LDOC_{it}+\beta_4 BED_{it}+\beta LGIN_{it}+\beta_6 LUNEM_{it}+\beta_7 LUR_{it}+U_{it} \quad (5)$$

In equations (3) and (5), "LH" denotes the logarithm of U5M, "LFDU" shows the logarithm of FD in the health sector, "LFDR" represents the logarithm of FD in the revenue aspect, "LGDP" denotes the logarithm of provincial per capita revenue, "LDOC" denotes the logarithm of density of physicians, "LBED" represents the logarithm of density of hospital beds, "LGIN" shows the logarithm of Gini coefficient, "LUNEM" denotes the logarithm of unemployment rate, and "LUR" shows the logarithm of urbanization. The descriptive statistics for the dependent variable and other variables of this study are shown in Table 2.

Estimation methods

The first step before doing any tests in the panel data econometrics is exploring the Cross-sectional Dependency (CD). Different tests such as Fridman test, Breusch test, and Pesaran CD test can be used for examining the CD. We used Pesaran CD test (42) to investigate the CD in model's variables. It should be noted that in the existence of CD in variables, the results of estimators were not reliable. Some methods such as Feasible Generalized Least Squares (FGLS), Panel-Corrected Standard Errors (PCSE) and Driscoll-Kraay Standard Errors (DKSE) are used as a remedy for the CD (43,44). In this study as we had CD, we used DKSE. In the second step, we used Hausman test to examine whether the model had fixed or random effects (45).

Results

Cross-sectional dependency test

Table 3 shows the results of CD test for the variables of our model in the provinces of Iran between 2007 and 2010. The null hypothesis of this test was that no CD existed among the variables. As the table presents, except for the LBED, all the variables had CD.

Fixed or random effects

We used Hausman test to see if the model had fixed or random effects. First, we estimated the model with random effects and used Hausman test. The null hypothesis for this test was that the differences between the coefficients were not systematic. According to Table 4, we had to estimate two equations with

Table 2. Descriptive statistics

Variables	Mean	Standard error	Minimum	Maximum
U5M	5.67	0.13	3.00	10.30
FDU	0.46	0.00	0.18	0.65
FDR	0.59	0.03	0.12	2.86
DOC	2.54	0.10	0.77	6.76
BED	1.43	0.36	0.92	2.62
GDP	37.00	1.31	11.18	91.46
UNEM	11.81	0.32	0.70	20.50
URB	0.64	0.01	0.47	0.95
GINI	0.32	0.00	0.25	0.42

Table 3. the results of the CD test

Variable	CD-test	*P*
LU5M	16.25	0.00
LFDU	68.27	0.00
LFDR	49.81	0.00
LGDP	77.42	0.00
LBED	1.44	0.14
LDOC	24.84	0.00

Citation: Samadi AH, Keshtkaran A, Kavosi Z, Vahedi S. The effect of fiscal decentralization on under-five mortality in Iran: a panel data analysis. *International Journal of Health Policy and Management* 2013; 1: 301–306.

fixed effects.

The findings of the estimation

Because of having fixed effects and cross-sectional dependency, the equations were estimated by fixed effects estimating technique using DKSE. The findings of these estimations are presented in Tables 5 and 6.

As shown in Table 4, except for urbanization (P= 0.37), all the other variables had a significant relationship with U5M (α= 0.05).

As Table 5 depicts, all the variables had a significant relationship with U5M (α= 0.05).

Discussion

The results of our study showed that the FD in the health sector (i.e. FDU) had a significant direct negative relationship with U5M. Hence, by increasing FD related to the health sector; the children's mortality was expected to decline. A 1% increase in this variable, averagely declined U5M by 0.09. This result is compatible with most of the studies conducted on this issue (1,5,10,11,21–25).

According to the study results, FDR in equation (2) had a statistically significant positive relationship with U5M. This result was in contrast to the theoretical basis and most of the studies performed on this issue (1,5,10,11,21–25). However, Jin and Son (25) in their study showed a positive relationship between FD and the health outcomes. This result can be explained by the inadequacy of the provincial incomes that are insufficient to fulfill the provincial needs, which may affect the provinces' health status. Furthermore, the absence of skilled human powers and necessary substructure in local levels can be accounted for a decrease in the capabilities of provinces to take advantage of decentralization.

In this study, DOC had a statistically significant negative association with U5M. Therefore, With the increase in DOC, utilization of healthcare services which influences the children's health is expected to increase, as well. This result is in line with the studies that investigated the impact of physicians on U5M (31,32). Similar to DOC, the coefficient of BED had a statistically significant negative relationship with the dependent variable. Therefore, an increase in BED is expected to decrease U5M. This finding was also consistent with related studies (22,33). GDP had a statistically significant negative relationship with U5M. Hence, an increase in the income per capita is expected to decrease the children's mortality. This result is compatible with the related studies (31,32–38). It should be pointed that, the income per capita is a prominent factor in reducing the children's mortality. In contrast, the Gini coefficient had a significant positive relationship with U5M. Since, Gini coefficient is representative of income inequality, income inequality is an important risk factor for children mortality. With an increase in Gini, most of the children are faced with difficulty in having access to vital needs, such as food, housing, and healthcare services (19). Similar result was found in a study by Filmer and Pritchett (34) which showed that income inequality increased children mortality in low- and middle-income countries.

According of findings of our study, the URB variable has a positive association with U5M. But this relationship is statistically significant in the second equation. This result is in line with Rajkumar and Swaroop (37). They showed that urbanization is accompanied with increase in children mortality in Indian states.

The findings also suggested that UNEM had a significant positive relationship with U5M. Therefore, unemployment should be accounted as a risk factor for children mortality. As unemployment rises, the mean incomes tend to decrease. If we accept that income has a negative impact on mortality, with an increase in unemployment, mortality should be expected to rise up. Nonetheless, Rohem showed that mortality was higher in smaller unemployment rates (39,40). These results were inconsistent with those obtained by Ariizumi (41) that found no significant relationships between unemployment and children mortality.

Conclusion

In this article, we showed that FD in the health sector was accompanied by lower children mortality. Hence, our results indicated that FD in the health sector is a booster factor for improving the health outcomes. Our study also revealed that decentralization of provincial revenues was associated with additional children mortality. Also, the findings of the current study demonstrated that U5M had a negative relationship with income per capita, density of physicians, and hospital beds, but

Table 4. The results of Hausman test

	X^2 (DF*)	*P*
Equation (3)	12.15 (7)	0.00
Equation (5)	14.86 (7)	0.00
*Degree of freedom		

Table 5. Estimated coefficients using FDU as a measure of FD

LU5M	Coef.	Std. Err.	t	*P*
LFDU	-0.09	0.04	-2.20	0.00
LDOC	-0.27	0.03	-5.91	0.00
LBED	-0.20	0.08	-2.54	0.02
LGDP	-0.42	0.05	-8.17	0.00
LGINI	0.75	0.07	9.67	0.00
LURB	1.76	0.93	1.89	0.37
LUNEM	0.04	0.01	2.55	0.02
_cons	4.96	0.59	8.29	0.00
R-sq within =0.36		F (7,15) = 40.93 Prob > F = 0.00		

Table 6. Estimated coefficients using FDR as a measure of FD

LU5M	Coef	Std. Err.	t	*P*
LFDR	0.05	0.01	4.19	0.00
LDOC	-0.27	0.05	-5.44	0.00
LBED	-0.25	0.06	-4.15	0.00
LGDP	-0.47	0.03	-12.1	0.00
LGINI	0.81	0.06	12.72	0.00
LURB	2.18	0.69	3.14	0.00
LUNEM	0. 05	0.01	3.62	0.00
_cons	5.51	0.35	15.75	0.00
R-sq within= 0.36		F (7,15)= 30.95 Prob > F= 0.00		

Citation: Samadi AH, Keshtkaran A, Kavosi Z, Vahedi S. The effect of fiscal decentralization on under-five mortality in Iran: a panel data analysis. *International Journal of Health Policy and Management* 2013; 1: 301–306.

a positive association with Gini coefficient, urbanization and unemployment rate. Hence, U5M can be reduced by adopting economic development policies and increasing the density of physicians and hospital beds. Finally, it should be pointed that the investigation of the effects of FD on other health outcomes such as infant mortality and life expectancy could be interesting issues for future studies.

Acknowledgements

This research was performed by Mr. Sajad Vahedi, in partial fulfillment of the requirements for certification as an MSc in Health Economic School at Shiraz University of Medical Sciences (SUMS) in Shiraz, Iran.

The present article was adopted from the proposal number 91-6366 approved by vice-chancellor for research affairs of SUMS. We would like to thank Research Improvement Center of the SUMS. Also we thank Ms. A. Keivanshekouh for her help to improve the English presentation of this paper.

Ethical issues

This study was approved by the ethics committee of SUMS.

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

SV and AHS designed and conducted the study. They analyzed and interpreted the data with the help of AK, ZK and SV provided the draft of the manuscript and revised it.

References

1. Uchimura H, Jütting JP. Fiscal Decentralization, Chinese Style: Good for Health Outcomes? *World Dev* 2009; 37: 1926–34.
2. Rondinelli DA. Government decentralization in comparative perspective theory and practice in developing countries. *International Review of Administrative Sciences* 1980; 47: 133–45.
3. Saltman RB, Bankauskaite V. Conceptualizing decentralization in European health systems: a functional perspective. *Health Econ Policy Law* 2006; 1: 127–47.
4. Oates WE. On the theory and practice of fiscal decentralization [internet]. 2006. Available from: http://www.ifigr.org/publication/ifir_working_papers/IFIR-WP-2006-05.pdf
5. Asfaw A, Frohberg K, James KS, Jütting J. Fiscal Decentralization and Infant Mortality: Empirical Evidence from Rural India. *Journal of Developing Areas* 2007; 41: 17–35.
6. Ebel RD, Yilmaz S. Concept of fiscal decentralization and worldwide overview [internet]. 2002. Available from: http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2004/11/02/000090341_20041102092746/Rendered/PDF/303460Concept0of0Fiscal0Ebel1Yilmaz.pdf
7. Oates WE. Fiscal Decentralization and Economic Development. *Natl Tax J* 1993; 46: 237–43.
8. Ebel RD, Yilmaz S. On the measurement and impact of fiscal decentralization [internet]. 2002. Available from: http://www-wds.worldbank.org/servlet/WDSContentServer/WDSP/IB/2002/04/12/000094946_02040304241194/Rendered/PDF/multi0page.pdf
9. Mills A. Decentralization and accountability in the health sector from an international perspective: what are the choices? *Public Adm Dev* 1994; 14: 281–92.
10. Robalino D, Picazo O, Voetberg A. Does fiscal decentralization improve health outcomes? Evidence from a cross-country analysis [internet]. 2001. Available from: http://elibrary.worldbank.org/doi/pdf/10.1596/1813-9450-2565
11. Jiménez-Rubio D. The impact of fiscal decentralization on infant mortality rates: Evidence from OECD countries. *Soc Sci Med* 2011; 73: 1401–7.
12. Costa-i-Font J. Fiscal Federalism and European Health System Decentralization: A Perspective [internet]. 2012. Available from: http://www.lse.ac.uk/europeanInstitute/LEQS/LEQSPaper55.pdf
13. Renani M, Sameti M, Farazmand H. [The relationship of fiscal decentralization and government size in Iran]. *Iranian Economic Research* 2008; 8: 121–55.
14. Ahsan K, Karampour K. [Provincial Revenue-Expenditure System: A New View on the Challenges and Prospects of Regional Development and Balance]. *The Journal of Planning and Budgeting* 2003; 8: 71–96.
15. World Bank. *Islamic Republic of Iran - Health Sector Review: Volume 2. Background Sections*. Washington: World Bank; 2008.
16. Majdzadeh R, Nedjat S, Denis JL, Yazdizadeh B, Gholami J. Linking research to action' in Iran: Two decades after integration of the Health Ministry and the medical universities. *Public Health* 2010; 124: 404–11.
17. WHO Regional Office for the Eastern Mediterranean. Regional Health Observatory [homepage on the Internet]. 2002. Available from: http://rho.emro.who.int/rhodata/
18. Infant and Child Mortality. In: Kirch W, editor. *Encyclopedia of Public Health*. Dresden: Springer; 2008.
19. Wagstaff A, Claeson M. *The millenium development goals for health: rising to the challenges*. Washington: The World Bank; 2004.
20. Santerre RE, Neun SP. *Health Economics*. 5th edition. Mason: Joe Sabatino; 2010.
21. Habibia N, Huangb C, Mirandac D, Murillod V, Ranise G, Sarkarf M, *et al.* Decentralization and human development in Argentina. *Journal of Human Development* 2003; 4: 73–101.
22. Cantarero D, Pascual M. Analysing the impact of fiscal decentralization on health outcomes: empirical evidence from Spain. *Appl Econ Lett* 2007; 15: 109–11.
23. Jiménez-Rubio D. The impact of decentralization of health services on health outcomes: evidence from Canada. *Appl Econ* 2010; 43: 3907–17.
24. Akpan EO. Fiscal Decentralization and Social Outcomes in Nigeria. *European Journal of Business and Management* 2011; 3: 167–83.
25. Soto VE, Farfan MI, Lorant V. Fiscal decentralisation and infant mortality rate: The Colombian case. *Soc Sci Med* 2012; 74: 1426–34.
26. Jin Y, Sun R. Does fiscal decentralization improve healthcare outcomes? empirical evidence from china. *Public Finance and Management* 2011; 11: 234–61.
27. Department of Health - Office of Population and Family Health-Children's Health Administration. *The death of 59-month-old children*. Tehran: Ministry of Health and Medical Education; 2012.
28. National Portal of Statistics. Provincial data [internet]. Available from: http://amar.org.ir/Default.aspx?tabid=1633
29. National Portal of Statistics. Household income and expenditure statistics [Internet]. Available from: http://amar.org.ir/Default.aspx?tabid=111
30. The Office of Planning of Budget financial resources. *Public and private credits of the medical universities*. Tehran: Ministry of Health and Medical Education; 2012.
31. Anand S, Bärnighausen T. Human resources and health outcomes: cross-country econometric study. *Lancet* 2004; 364: 1603–9.
32. Robinson J, Wharrad H. Invisible nursing: exploring health outcomes at a global level. Relationships between infant and under five mortality rates and the distribution of health professionals, GNP per capita, and female literacy. *J Adv Nurs* 2000; 32: 28–40.
33. Olafsdottir AE, Reidpath DD, Pokhrel S, Allotey P. Health systems performance in sub-Saharan Africa: governance, outcome and equity. *BMC Public Health* 2011; 11: 237.
34. Filmer D, Pritchett L. The impact of public spending on health: does money matter? *Soc Sci Med* 1999; 49: 1309–23.
35. Houweling TA, Caspar AE, Looman WN, Mackenbach JP. Determinants of under-5 mortality among the poor and the rich: a cross-national analysis of 43 developing countries. *Int J Epidemiol* 2005; 34: 1257–65.
36. Chung H, Muntaner C. Political and welfare state determinants of infant and child health indicators: An analysis of wealthy countries. *Soc Sci Med* 2006; 63: 829–42.
37. Rajkumar AS, Swaroop V. Public spending and outcomes: Does

governance matter? *J Dev Econ* 2008; 86: 96–111.
38. Farahani M, Subramanian SV, Canning D. Effects of state-level public spending on health on the mortality probability in India. *Health Econ* 2010; 19: 1361–76.
39. Lichtenberg FR. Pharmaceutical Innovation and Longevity Growth in 30 Developing and High-income Countries, 2000-2009 [internet]. 2012. Available from: http://www.nber.org/papers/w18235.pdf?new_window=1
40. Ruhm CJ. Healthy living in hard times. *J Health Econ* 2005; 24: 341–63.
41. Ariizumi H, Schirle T. Are recessions really good for your health? Evidence from Canada. *Soc Sci Med* 2012; 74: 1224–31.
42. Pesaran MH. *Estimation and Inference in Large Heterogeneous Panels with a Multifactor Error Structure*. Cambridge: Cambridge University; 2004.
43. Driscoll JC, Kraay AC. Consistent covariance matrix estimation with spatially dependent panel data. *Rev Econ Stat* 1998; 80: 549–60.
44. Hoechle D. Robust standard errors for panel regressions with cross-sectional dependence. *Stata J* 2007; 7: 281.
45. Hsiao C. *Analysis of panel data*. 2nd edition. Cambridge: Cambridge university press; 2003.

Citation: Samadi AH, Keshtkaran A, Kavosi Z, Vahedi S. The effect of fiscal decentralization on under-five mortality in Iran: a panel data analysis. *International Journal of Health Policy and Management* 2013; 1: 301–306.